Claims

What is claimed is:

1. A silica optical waveguide comprising:

a core region having a first refractive index profile by virtue of comprising a first mixture of isotopes of silicon and oxygen; and

a cladding region having a second refractive index profile by virtue of comprising a second mixture of isotopes of silicon and oxygen, wherein the first and second mixtures include different isotopic concentrations of silicon and oxygen.

2. The silica optical waveguide of claim 1, wherein:

the refractive index throughout the core region is substantially uniform;

the refractive index throughout the cladding region is substantially uniform; and

the refractive index of the core region is greater than the refractive index of the cladding region.

3. The silica optical waveguide of claim 2, wherein the cladding region consists of natural abundance silica.

4. The silica optical waveguide of claim 2, wherein the core region is enriched for ^{30}Si or ^{29}Si.

5. The silica optical waveguide of claim 2, wherein the core region is enriched for ^{18}O.

6. The silica optical waveguide of claim 2, wherein the core region is further doped with germania.

7. The silica optical waveguide of claim 2, wherein the cladding region is further doped with fluorine.

8. The silica optical waveguide of claim 2, wherein the core region is further doped with erbium, ytterbium, or a combination thereof.

9. A wavelength-division multiplexed optical communication system comprising the silica optical waveguide of claim 1.

10. A time-division multiplexed optical communication system comprising the silica optical waveguide of claim 1.

11 A soliton optical communication system comprising the silica optical waveguide of claim 1.

12. A Raman optical amplification system comprising the silica optical waveguide of claim 1.

13. The silica optical waveguide of claim 1, wherein:
the refractive index throughout the core region is substantially uniform;
the refractive index of the cladding region is non-uniform; and
the refractive index of the core region is greater than the highest refractive index of the cladding region.

14. The silica optical waveguide of claim 13, wherein the refractive index of the

cladding region decreases smoothly and monotonically with increasing distance from the boundary of the core region and the cladding region.

15. The silica optical waveguide of claim 14, wherein the refractive index of the cladding region decreases parabolically with increasing distance from the boundary of the core region and the cladding region.

16. The silica optical waveguide of claim 14, wherein the refractive index of the cladding region decreases linearly with increasing distance from the boundary of the core region and the cladding region.

17. The silica optical waveguide of claim 14, wherein the refractive index of the cladding region decreases in a series of *n* steps with increasing distance from the boundary of the core region and the cladding region, and *n* is an integer between 1 and 100.

18. The silica optical waveguide of claim 13, wherein the concentration of ^{30}Si or ^{29}Si decreases from the boundary of the core region and the cladding region to the outer edge of the cladding region.

19. The silica optical waveguide of claim 13, wherein the concentration of ^{18}O decreases from the boundary of the core region and the cladding region to the outer edge of the cladding region.

20. The silica optical waveguide of claim 13, wherein the cladding region is further doped with germania, and the concentration of germania decreases from the boundary of the core region and the cladding region to the outer edge of the cladding region.

21. The silica optical waveguide of claim 13, wherein the cladding region is further doped with fluorine, and the concentration of fluorine increases from the boundary of the core region and the cladding region to the outer edge of the cladding region.

22. An optical waveguide comprising:

a core region having a first refractive index profile by virtue of comprising a first mixture of isotopes of at least one element; and

a cladding region having a second refractive index profile by virtue of comprising a second mixture of isotopes of said at least one element.

23. The optical waveguide of claim 22, wherein said at least one element comprises gallium, arsenic, or a combination thereof.

24. The optical waveguide of claim 23, wherein the core region is further doped with germania.

25. The optical waveguide of claim 24, wherein the cladding region is further doped with fluorine.